

SELECTION OF WOODY FOOD BY TERMITES (ISOPTERA) AT THE HARRY WARING MARSUPIAL RESERVE NEAR JANDAKOT, WESTERN AUSTRALIA

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ABSTRACT

A minimum of seventeen termite species occur at the Harry Waring Marsupial Reserve. *Coptotermes michaelsoni*, *Occasitermes occasus*, *Heterotermes platycephalus*, *Amitermes conformis* and *Kaloterms aemulus* were most frequently encountered in samples of wood. For these most common species, we examined their food selection. Termites built foraging galleries in several but not all of the recorded wood categories. None of the termites, however, used the categories in the same proportion in which they were available. In particular, *Coptotermes michaelsoni* and *Occasitermes occasus* showed a preference for *Eucalyptus marginata* sticks and branches on the ground, over the more numerous *Banksia* sticks and branches.

INTRODUCTION

This paper presents the results of a survey of the preferred food of wood-eating termites in the Harry Waring Marsupial Reserve of the Department of Zoology, University of Western Australia, near Jandakot (32°10'S, 115°30'E; Figure 1).

A general description of the Harry Waring Marsupial Reserve and some accounts of the flora and fauna are in Whelan and Main (1979) and Whelan and Burbidge (1980). In brief, the Reserve occurs on the boundary of the Bassendean and Spearwood Dune systems and contains vegetation common to the coastal plain *Banksia* woodlands. *Banksia attenuata* and *B. menziesii* are the most common trees, with *Eucalyptus marginata*, *Allocasuarina fraserana*, *Jacksonia sternbergiana* and *J. furcellata* making up a much smaller proportion of the larger woody species. The Reserve includes two swamps and one lake, Banganup, separated by ridges which rise fifteen metres above the lake.

Certain aspects of the ecology of Western Australian termites are

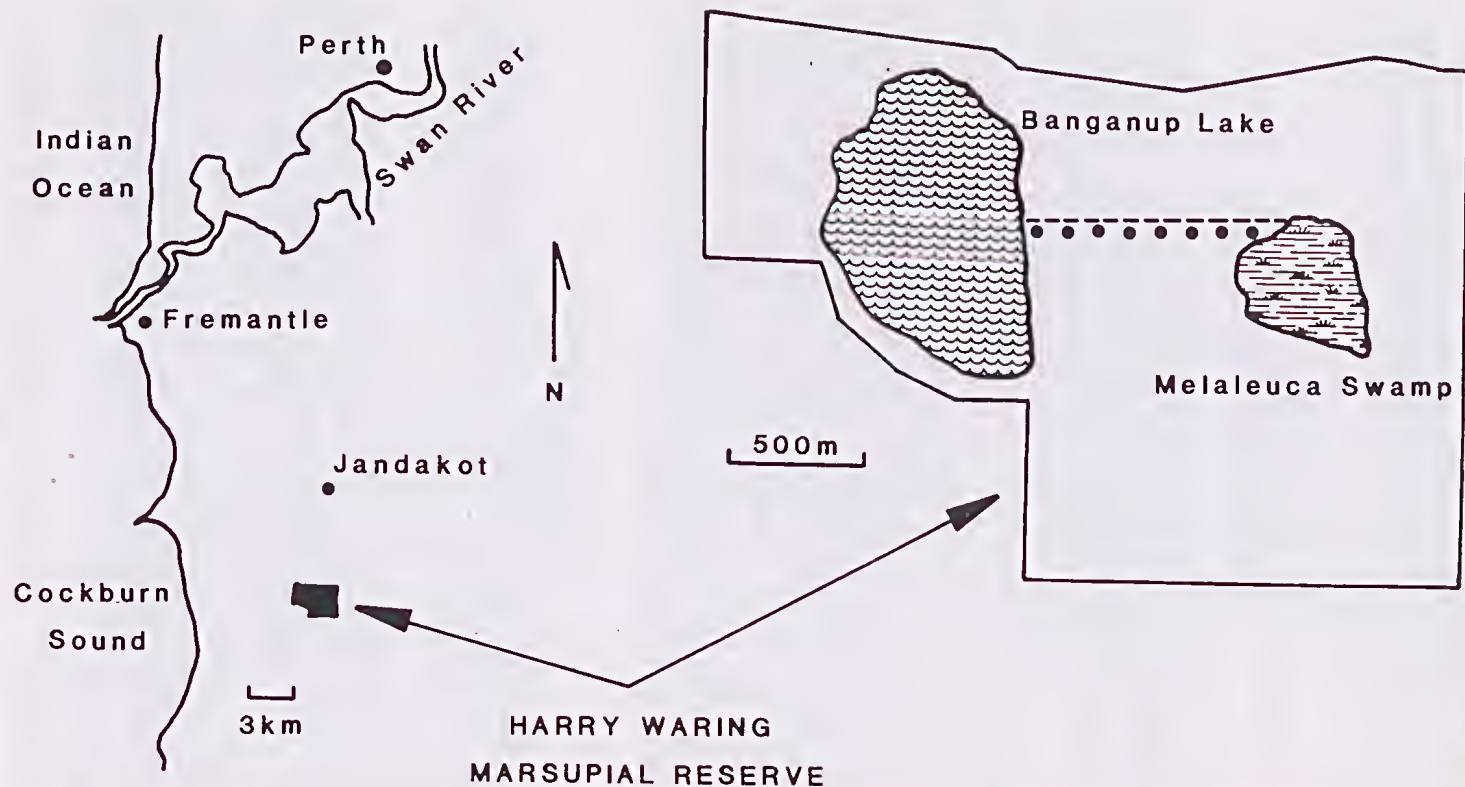


Figure 1. Map showing the Harry Waring Marsupial Reserve near Jandakot showing location of transects (----) and quadrats (....).

reasonably well understood. Published studies include a checklist of species for Barrow Island (Perry 1972), the role of termites in the rehabilitation of bauxite mine-sites (Bunn 1983), damage by termites to forest trees (Perry, Lenz and Watson 1984), a guide to the termites from the extreme southwest (Perry *et al.* 1985), and various aspects of the ecology of termites in the semi-arid wheatbelt (Abensperg-Traun and De Boer 1990; Abensperg-Traun 1991, 1992). Selection of woody food by Australian termites in general, and by the termites of Western Australia in particular, is poorly understood, although food selection of economically important termites, such as *Coptotermes* spp., is better known (e.g. Greaves 1962). This paper provides a list of termite species found within the Harry Waring Marsupial Reserve, and describes the utilization of woody food by the five most common species.

METHODS

On 19 and 20 July 1980, an intensive search for termites was made at the Reserve (Figure 1). This was intended to provide quantitative information about the amounts and kinds of wood available to the termites, and the extent to which these were utilized by foraging termites.

Two methods were used to determine selection of woody food by the termites. First, standing trees, stumps, and fallen logs, branches of all species of tree, and fruits of *Banksia* spp., were examined along a 1000 m transect between the edge of Banganup lake and *Melaleuca* swamp (Figure 1). When an active foraging gallery was located, soldiers were collected to identify the species by comparison to a reference collection based on material kindly provided by Mr. D.H. Perry who had recorded 17 species during a general survey prior to this study. In addition to species of termite, we recorded the part of the tree where the gallery of foraging termites occurred, and where possible the species of wood. Where the wood was in advanced stages of decay, we identified the wood sample to genus. Stumps, logs, branches, sticks, and bark were dead wood on the ground.

Second, termites were sampled in nineteen, 10 x 10 m quadrats selected at random, parallel to the previous transect (Figure 1). We recorded termite species, the part of the tree where the gallery of foraging termites occurred, and the species of wood. Within each quadrat we counted categories of wood in order to provide an estimate of the available material for termites, in addition to those which were actually used.

RESULTS AND DISCUSSION

A total of 178 active galleries of termites belonging to ten species were found along the transect and in the quadrats (Table 1). More

Table 1. The relative abundance of galleries of ten species of termites found in dead wood at the Harry Waring Marsupial Reserve.

SPECIES OF TERMITES	NUMBERS OF GALLERIES FOUND	
	Transect	Quadrats
<i>Coptotermes michaelseni</i>	53	14
<i>Occasitermes occasus</i>	29	2
<i>Heterotermes platycephalus</i>	10	18
<i>Amitermes conformis</i>	15	2
<i>Kalotermes aemulus</i>	8	4
<i>Amitermes heterognathus</i>	5	3
<i>Heterotermes occiduus</i>	5	1
<i>Nasutitermes exitiosus</i>	1	4
<i>Tumulitermes apiocephalus</i>	3	0
<i>Hesperotermes infrequens</i>	1	0
Total	130	48

than one third of the galleries were of *Coptotermes michaelseni*. *Occasitermes occasus* and *Heterotermes platycephalus* were next most abundant with about 15 % each of the galleries. *Amitermes conformis* had about 10 % of the galleries and *Kalotermes aemulus* only slightly more than 5 %. The remaining five species each occurred in less than 5 % of the total galleries. In addition to the ten species given in Table 1, D.H. Perry identified seven other species of termite which we did not sample. These are *Coptotermes acinaciformis raffrayi*, *Heterotermes ferox*, *Xylochomitermes occidualis*, *X. tomentosus*, *Amitermes modicus*, *Paracapritermes kraepelinii*, and *Microcerotermes newmani*.

Table 2 shows the relative abundance of items in the categories of dead wood in the 19 quadrats, which were considered to be available to foraging termites. *Banksia* species were clearly the most abundant trees. In particular, *B. attenuata* dominated the woodland, occurring at a density equivalent to 200 vertical trunks per hectare compared with 116 trees per hectare of all other species. As a consequence much

Table 2. Number of potentially suitable wood items for termites in nineteen 10 m x 10 m quadrats at the Harry Waring Marsupial Reserve.

SPECIES OF TREE	PART OF TREE		
	Vertical trunk	Stump	Stick or fruit
<i>Banksia</i> species	8	17	95
<i>B. attenuata</i>	38	3	38
<i>B. menziesii</i>	9	0	5
<i>Jacksonia</i> spp.	3	5	5
<i>Eucalyptus marginata</i>	0	0	4
<i>E. rudis</i>	0	0	0
<i>Melaleuca</i> spp.	0	2	0
<i>Allocasuarina fraserana</i>	2	2	13
Undetermined	0	3	0
Total	60	32	160

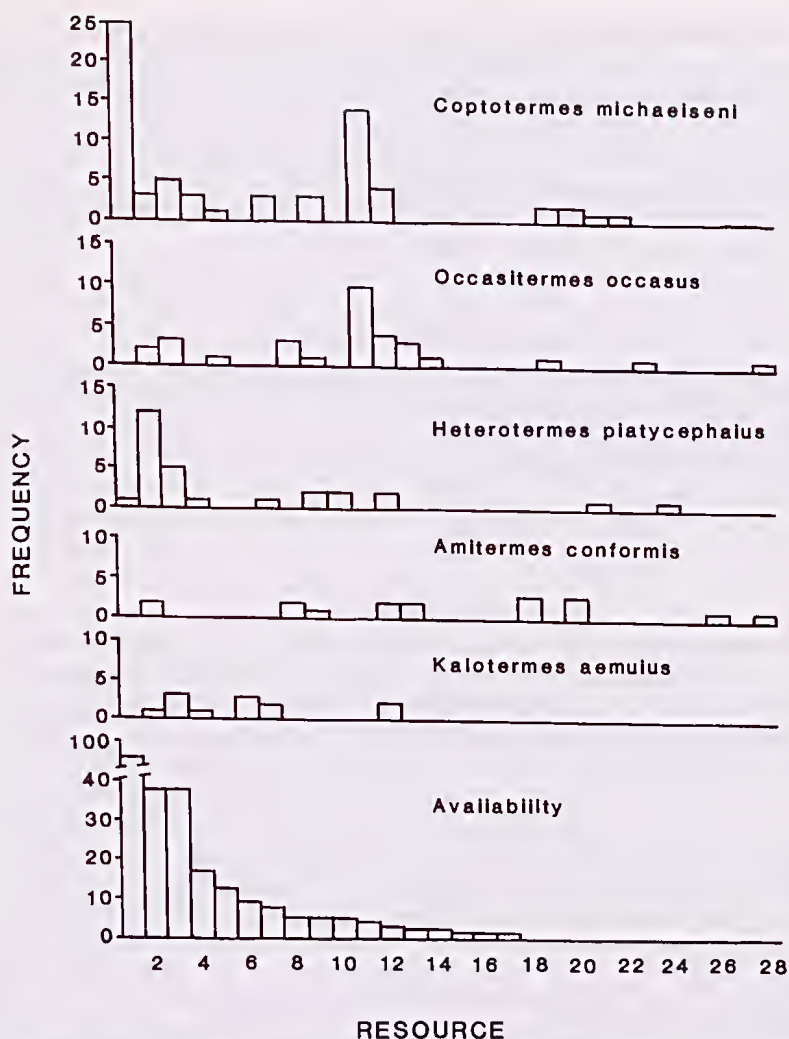


Figure 2. Availability and utilization of wood items by the five termite species with the most abundant galleries at the Harry Waring Marsupial Reserve.

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|--|---|
| 1. <i>Banksia</i> sp. sticks, branches | 15. <i>Melaleuca</i> sp. stump |
| 2. <i>B. attenuata</i> sticks, branches | 16. <i>A. fraserana</i> stump |
| 3. <i>B. attenuata</i> vertical trunk | 17. <i>A. fraserana</i> vertical trunk |
| 4. <i>Banksia</i> sp. stump | 18. <i>B. menziesii</i> stump |
| 5. <i>Allocasuarina fraserana</i> sticks, branches | 19. <i>E. marginata</i> stump |
| 6. <i>B. menziesii</i> vertical trunk | 20. <i>E. rudis</i> sticks, branches |
| 7. <i>Banksia</i> sp. vertical trunk | 21. <i>Melaleuca</i> sp. sticks, branches |
| 8. <i>B. menziesii</i> sticks, branches | 22. Undetermined sticks, branches |
| 9. <i>Jacksonia</i> sp. sticks, branches | 23. <i>E. marginata</i> vertical trunk |
| 10. <i>Jacksonia</i> sp. stump | 24. <i>Melaleuca</i> sp. vertical trunk |
| 11. <i>Eucalyptus marginata</i> sticks, branches | 25. <i>B. attenuata</i> bark |
| 12. <i>B. attenuata</i> stump | 26. <i>E. rudis</i> bark |
| 13. Undetermined stump | 27. <i>A. fraserana</i> bark |
| 14. <i>Jacksonia</i> sp. vertical trunk | 28. <i>Jacksonia</i> sp. stump below ground |

of the dead branch wood, sticks and fruit on the ground were *Banksia* and these formed 55 % of the items of all the wood categories counted in this sample. Non-*Banksia* items in categories of any sort made up only 15 % of the total available items.

Figure 2 combines the information on the availability of wood items and the occurrence of termites in the 24 (17 + 7) categories of Table 2, known to be used, and 4 other items used by termites sampled in the transect: bark of *Banksia attenuata*, *E. rudis*, and *Allocasuarina fraserana*, and below ground stump of *Jacksonia* spp. Data for only the five most abundant termite species have been included, omitting those species for which there are fewer than ten records (Table 1). In Figure 2 the wood categories are ranked from the most abundant (1) to the least abundant (17) as shown in Table 2. The additional 11 food types are listed in the caption of the figure and were recorded from the transect.

The comparison of availability of different wood categories and usage by foraging termites indicated some degree of preference for some species (Figure 2). The most abundant termite, *Coptotermes michaelseni*, had 37 % of its galleries in *Banksia* sp. sticks and fruit on the ground, and 21 % in sticks of *Eucalyptus marginata* compared to the availability of 38 % and 2 % respectively. Such preference by *C. michaelseni* for eucalypt wood is consistent with the findings of other studies for the genus in general (Calaby and Gay 1956). Unlike other species of *Coptotermes*, however, *C. michaelseni* can sustain itself on non-eucalypt food (Perry *et al.* 1985). The extent to which other wood species are selected appears to be poorly known for the species (Calaby and Gay 1956). The relative scarcity of *Eucalyptus* trees in the study area (Table 2) probably explains the absence (or scarcity) of the larger *C. acinaciformis raffrayi* (Gay and Calaby 1970), which is an important species in nearby Jarrah forest (Bunn 1983). Preference for eucalypt food was also shown by *Occasitermes occasus* which had 32 % of its galleries in *E. marginata* sticks, but none in *Banksia* sticks. Elsewhere, the species attacks both hardwoods and softwoods, and is known to frequently forage in dead *Banksia* spp. trees (Gay 1974). In this study, however, *Banksia* was clearly not a preferred food. *Heterotermes platycephalus* was not sampled in any of the *Eucalyptus* samples, with most foraging records from the abundant *Banksia* wood. *Amitermes conformis* showed no particular preference, with foraging records from *Banksia attenuata*, *Jacksonia* spp. and *Eucalyptus rudis*. *Kaloterms aemulus* was found mostly in stumps and the vertical trunks of *Banksia* spp. and rarely in any of the other wood categories. The species is known to nest in stumps and trunks of *Eucalyptus marginata* and at least five species of *Banksia* (Sewell and Gay 1978), with *Banksia* the preferred food (D.H. Perry, pers. comm.).

The five species represented used a wide range of wood categories, varying from 13 used by 67 galleries of *Coptotermes michaelseni* to 6 used by the 12 galleries of *Kaloterms aemulus* (Figure 2; Table 1). In fact, we found that more intensive sampling would have increased

the diversity of woody food shown to be used by the termite species. This is explained by the fact that with an increase in the number of foraging galleries that we recorded for respective termite species (Table 1), the number of wood categories each species used also increased (Figure 2, and the data for the five rarer species) ($r = 0.888, 8$ d.f., $P < 0.001$). Nevertheless, we believe that our sampling was sufficient to identify those food items of greatest importance to the termites.

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